

*ENVIRONMENTAL ASSESSMENT
OF THE
OPERATION AND MAINTENANCE
OF*

EDWARD MacDOWELL LAKE

NUBANUSIT RIVER

**PETERBOROUGH, HANCOCK, HARRISVILLE
& DUBLIN, NEW HAMPSHIRE**

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PREFACE

The purpose of this Environmental Assessment is to provide the basis for evaluation of the environmental impact of the project area due to the routine operation and maintenance of this flood control reservoir. Edward MacDowell Dam has been operated whenever necessary since it was constructed to prevent or reduce downstream flooding. Maintenance and management of the project, including the recreation facilities, during non-flood periods is also of primary importance. Enhancement of the fish and wildlife resources as well as protection of the environment within and around the reservoir area has been given careful consideration.

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I. PROJECT DESCRIPTION

A. INTRODUCTION

1. Location and Authorization

The Edward MacDowell Dam and impoundment area are located in the towns of Dublin, Harrisville, Hancock and Peterborough, New Hampshire. The dam was built across the Nubanusit Brook in Peterborough, a tributary of and close to the headwaters of the Contoocook River. The dam is one-half mile upstream from the village of West Peterborough and 14 miles east of Keene.

Authorization for the Edward MacDowell Dam was contained in the 1936 Flood Control Act (Public Law 760) and modified by the 1938 Flood Control Act.

Edward MacDowell Dam and Reservoir were constructed at a total cost of \$2,934,300 and the project became operational in March of 1950.

2. Purpose

The project is one of three Corps projects, the others being Hopkinton-Everett Lakes and Blackwater Dam, built in the Contoocook River basin. It provides substantial flood protection for Peterborough and other communities in the upper Contoocook River basin and, integrated with other Merrimack River basin projects, it also provides a measure of protection to potential damage centers further downstream on the Contoocook. The MacDowell Dam controls about one-third, or 44 square miles, of the Contoocook drainage basin above Peterborough; the

rest of the upstream waters of the Contoocook are uncontrolled until they flow into the impoundment area behind Hopkinton Dam, 35 miles downstream on the Contoocook, near the town of Hopkinton.

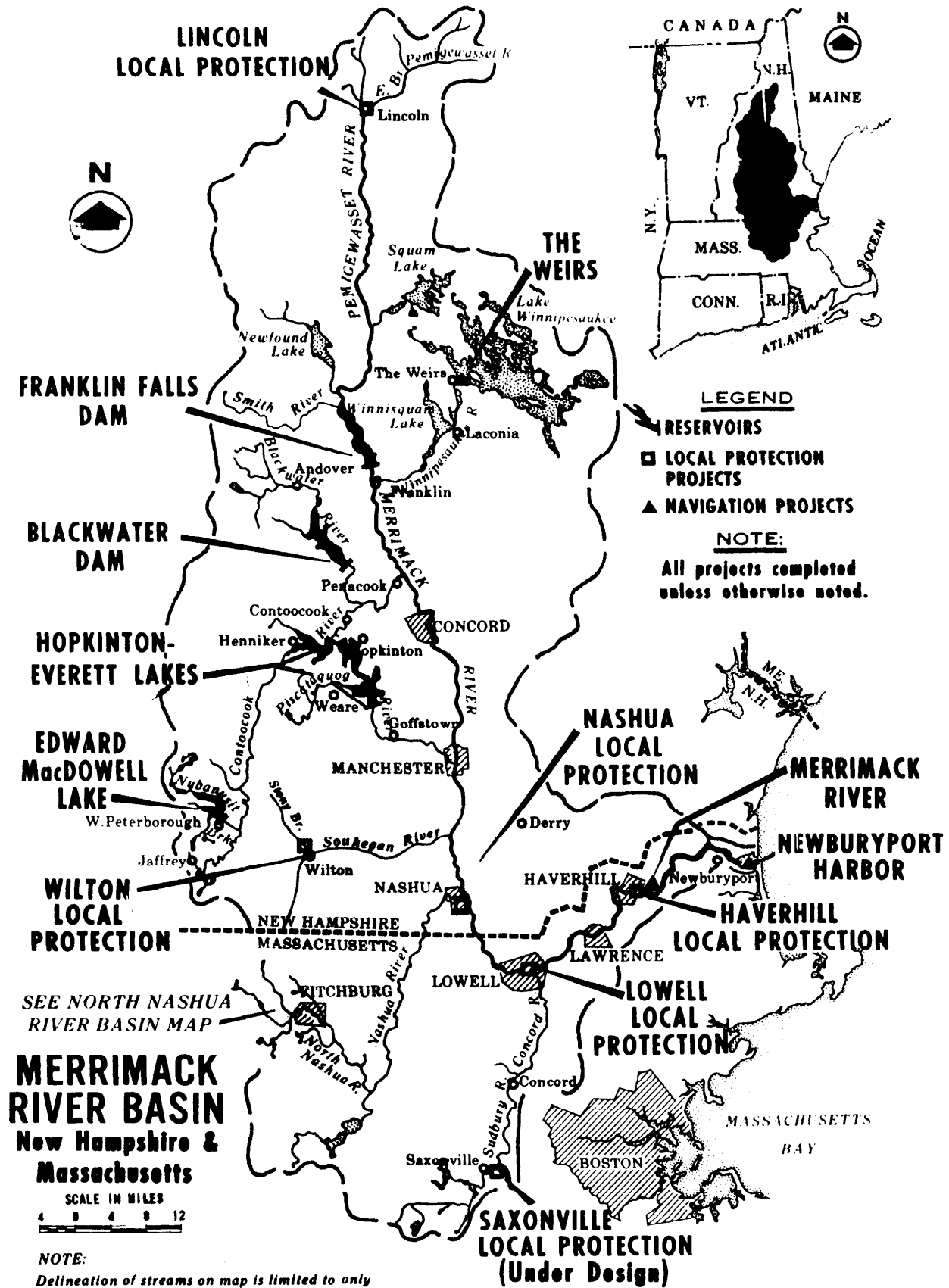
B. STRUCTURES AND RESERVOIR

1. Dam

Edward MacDowell Dam, built across Nubanusit Brook, is of the rolled-earth type with a dumped rock blanket on the upstream face and a rock toe on the downstream face. It is 1030 feet long with a maximum height of about 63 feet above stream bed. The elevation of the top of the dam is 967 feet above mean sea-level (msl). A roadway tops the entire length of the dam. Designed surcharge at the dam is 15 feet, to an elevation of 961 feet msl.

2. Spillway

The spillway is located 3.2 miles north of the dam, just northeast of Halfmoon Pond. Discharge is designed to flow into Davis Brook, Ferguson Brook and thence into the Contoocook River downstream from Peterborough. The chute spillway has an ogee weir, 100 feet long, with a crest elevation of 946 feet msl. In conjunction with the spillway channel, which is cut through bedrock, is a low dike, paralleling the channel on the north side and built to contain the spillway discharge. The spillway channel is about 1700 feet long. Two public roadways, one above and the other downstream from the weir, cross the spillway channel on bridges. Designed surcharge at the spillway is 12.2 feet, or 958.2 feet msl, reflecting a 2.8 foot loss of hydraulic head which would accumulate over the more than three-mile distance separating the dam from the spillway. Maximum discharge capacity at the spillway is 16,600 cfs.



3. Outlet Works

A seven-foot square conduit, 275 feet in length, passes under the dam. Flow through it is controlled from the intake tower by three slide gates, each three feet by seven feet. The conduit empties into a 25-foot by 40-foot stilling basin and then into a small pool upstream of the old Verney Mills Dam.

Maximum discharge capacity from the outlet works with flood waters at an elevation of 946 feet msl is 1600 cfs. Downstream non-damaging channel capacity of Nubanusit Brook is about 650 cfs.

4. Reservoir

A small permanent pool or conservation pool is maintained upstream from Edward MacDowell Dam. Its surface elevation varies from about 910 feet msl in the summer to 912 feet msl in the winter. Surface area of this pool is approximately 165 acres. The pool is maintained by the outlet gates in order to protect the outlet gates from freezing during the winter months and to enhance fisheries and wildlife habitat year-round. The depth of the permanent pool is a maximum of seven feet.

Within the rest of the project area there are three other smaller permanent bodies of water: Halfmoon Pond, and Dinsmoor and Beaver Ponds, short distances to the west and northwest of Halfmoon Pond. The latter two ponds are somewhat smaller than Halfmoon Pond, and have slightly higher surface elevations. Since all three ponds are upstream from the dam by more than three miles, impoundment of

flood waters first occurs in the pool just behind the dam and the level of stored water only gradually retreats northward to the area of these natural ponds.

The potential reservoir at spillway-crest elevation 946 feet msl is 840 acres in extent, about five miles long, and contains 12,650 acre-feet of flood control storage above the conservation pool. This volume represents 5.4 inches of runoff from the upstream drainage area of 44 square miles. Were the reservoir to be filled to maximum surcharge level (961 feet msl or 15 feet above spillway crest as measured at the dam) the area flooded would be 1,875 acres, with a volume of 18,800 acre-feet.

Since operations commenced at the dam in 1950, the reservoir pool has been filled to more than 50 percent of capacity only three times. The first was in April 1951 (52 percent or 6,700 acre-feet), the next in January 1956 (58 percent, or 7,400 acre-feet), and the most recent time was April 1960 (55 percent, or 7050 acre-feet). One inch of runoff in the drainage area behind the dam is equivalent to about 2350 acre-feet of stored water.

5. Real Estate

The Edward MacDowell project area contains 1194 acres acquired in fee. This acreage approximates the area defined by the maximum pool of 949 feet msl. An exception is the land bordering Halfmoon Pond, which is owned by Boston University and on which the University operates its Sargent Camp. There, and also on 156 acres of the low



land below the spillway channel bordering Davis and Ferguson Brooks between Middle Hancock Road (sometimes called "Tenney Road") and Route 202, additional acreage has been acquired by the Corps as flow-age easement land.

C. OPERATION PROCEDURES

A permanent conservation pool is maintained behind Edward MacDowell Dam by regulation of gates in the outlet works. Elevation of the pool is from 911 to 912 feet msl during the winter and one or two feet lower during the summer.

Until 1973 the old, privately constructed Verney Mills Dam a few hundred yards downstream from MacDowell Dam on Nubanusit Brook had been responsible for maintaining pool level in the permanent reservoir pool behind MacDowell Dam. This was due to the fact that water behind this downstream dam backed up through the outlet works of MacDowell Dam. In recent years, because the older dam posed safety problems, it was acquired by the Corps and its spillway was lowered to a depth of about eight feet. This action necessitates the regulation of the permanent pool by manipulating the gates at MacDowell Dam. Normal gate settings are between 0.5 and 0.7 feet on one or more gates.

Regulation of flow from the reservoir is initiated for heavy rainfall occurring over the Nubanusit Brook drainage basin and also for specific river stages as measured at the USGS gage on Nubanusit Brook in West Peterborough and the USGS gage on the Contoocook River at Noone's Mill, upstream from the confluence of Nubanusit Brook.

Regulation may be considered in three phases during the course of a flood:

Phase I, the appraisal of storm and river conditions during the development of a potential flood, leading to initial flow regulation; Phase II, regulation of reservoir discharge to reduce downstream flooding along the Nubanusit Brook and the Contoocook River; and Phase III, emptying the reservoir as rapidly and safely as possible following flood conditions.

D. MANAGEMENT PROGRAMS

The reservoir area is being managed, under license, by the New Hampshire Fish and Game Department as a habitat for waterfowl, as well as for other wildlife and fish.

Public recreation facilities are operated by the Corps and at present consist only of a picnic area located at the west end of the dam. Public swimming, except at the privately owned Sargent Camp on the Halfmoon Pond, is not encouraged. Snowmobiles are allowed on 200 acres of land in the project and on designated trails. No specified forestry management practices, except for routine maintenance, are undertaken at the project.

II. ENVIRONMENTAL SETTING

A. DESCRIPTION OF GENERAL AREA

1. Climate and Precipitation

The climate of the Nubanusit Brook basin is seasonally variable with a mean annual temperature of 45°F. Average monthly temperatures range from about 69°F in July to approximately 20°F in January.

The area lies in the path of prevailing westerlies but it is also exposed to Atlantic coastal storms, locally known as "nor'easters." Storms of tropical origin, sometimes of hurricane intensity and associated with extremely heavy rainfall, have infrequently occurred in the region during the late summer and early autumn.

The mean annual precipitation in the region is approximately 40 inches and slightly more at higher elevations. Average annual snowfall is about 68 inches.

2. Topography

The Nubanusit Brook basin drains southeastward from its headwaters at Nubanusit Lake 7 miles northwest of MacDowell Dam into the Contoocook River at Peterborough. The drainage divide, straddled by Mount Monadnock about 7 miles southwest of the dam and at an elevation of 3965 feet msl, forms the eastern perimeter of the Contoocook River basin. At the other extreme of elevation, the confluence of Nubanusit Brook with the Contoocook River, the drainage basin has an elevation of approximately 740 feet msl. The region between these extremes of elevation is characterized by rather broad, often marsh-covered, upland valleys bounded by hills and ridges with moderately steep slopes.

3. Vegetative Cover Types

The Nubanusit Brook basin is mostly wooded. An absence of trees is notable only around areas of open water and marsh. The forest cover is dominated by northern hardwoods such as oak, maple, beech,

poplar, birch and other species, interspersed with strands of white pine and hemlock. Marsh areas support various associations of grasses, ferns and shrubs.

A minor amount of vegetation, especially autumn olive, has been planted in a few places within the project area.

Small farmsteads dot the region but the cultivated acreage is a very small percentage of the drainage area.

4. Fish and Wildlife Species Present

Beaver colonies are scattered throughout the Nubanusit Brook drainage area. Deer, foxes, porcupines, skunks, snowhoe hares, fishers and river otters are also found in the vicinity of the project. Pheasants have been stocked by the New Hampshire Fish and Game Department and ruffed grouse are indigenous. Migrating waterfowl visit the area seasonally and are being encouraged by current wildlife management programs.

The shallow ponds and conservation pool provide good habitat for horned pout, pickerel, perch and bass. The Fish and Game Department annually stocks trout at various places in the area, especially in the brook below MacDowell Dam. Ice fishing is popular in the winter, as is angling for both warm and cold water species at other times of the year.

5. Geologic Features

The area is adjacent to a classical, well studied geomorphological feature, Mount Monadnock, which has lent its name to other glacially eroded features of the same type elsewhere in the world.

It can be inferred from the proximity of the Nubanusit Basin to the Mount Monadnock region, that both had nearly the same geologic history. The area is underlain by a complex of igneous and metamorphic rocks. Long after the bedrock was formed the region was uplifted and then eroded to a nearly featureless surface, from which Mount Monadnock protruded slightly as an anomalous and relatively uneroded prominence. In more recent times, during the Ice Ages and afterwards, further erosional action emphasized the anomaly and has been responsible for sculpturing both the slopes and summit of Mount Monadnock, as well as adjacent areas, and allowing the region's network of rivers and streams to entrench themselves in rather well-defined valleys.

6. Historic and Archeological Features

No historic and archeological features are known to exist within that area which might be flooded by the waters impounded by Edward MacDowell Dam.

7. Socioeconomic Conditions

The waters of the Nubanusit Brook drainage basin rise in eastern Cheshire County in the rural towns of Nelson, Harrisville, Dublin and Jaffrey, and flow in a southwesterly direction into Hillsborough County to Peterborough.

Populations of the four towns in Cheshire County increased from 4519 persons in 1960 to 5078 persons in 1970, an increase of about 12 percent. In that part of the Nubanusit drainage which

is within Hillsborough County, that is, the towns of Hancock and Peterborough, the census showed a 28 percent increase from 3685 persons to 4716 persons during the same period.

Peterborough and Jaffrey, each with a population of between 3000 and 4000, are the two largest towns in the immediate area, jointly comprising close to 75 percent of the region's population. Paper mills, printing plants and other industrial water-users are located along the Contoocook River in the vicinity of Peterborough. A ball bearing factory is Peterborough's largest employer. Outside of the two largest towns' developed areas the region is sparsely populated.

Agriculture is not an important source of income in the region. Most farms are family-sized operations and are primarily dairy farms. Scattered small-scale sawmills and adjunct timber operations are also found in the region.

The transportation network in the area is centered on the two highways which intersect at Peterborough: Route 202, which follows the Contoocook River north and south, and Route 101, which runs east-west. Additional roads serve mostly local traffic.

Recreational use of the area is moderate to heavy, especially in the summer, due mostly to the presence of the many seasonal homes used by vacationers and to the scattered intensive-use recreational facilities (private camps, state parks and ski areas). The region is located midway between two arterial interstate highways which traverse the more densely populated areas of southern

New England: Interstate 91 to the west, in the Connecticut River valley, and Interstate 93 to the east, which follows the Merrimack River valley through the cities of Nashua, Manchester and Concord.

B. WATER USES

Within the project area the water resources serve principally to support fish and wildlife habitat, and thereby enhance recreational fishing and hunting. However, at Halfmoon Pond and Boston University's Sargent Camp, year-round recreational and educational programs are conducted, some of which utilize that body of water for swimming and other purposes.

C. INTERRELATIONSHIPS WITH OTHER PROJECTS

As earlier mentioned, the Edward MacDowell Dam's flood control operations are integrated with those of Hopkinton-Everett Lakes and Blackwater Dam. All three projects are managed as part of the larger regional Merrimack River flood control program.

Furthermore, coordination of land and water use within the MacDowell Dam project is arranged through a management agreement between the Corps and the New Hampshire Fish and Game Department. Aside from fishing, hunting and provision for use of the area by snowmobiles and picnickers within specified areas, there is no other organized use of the project lands.

III. ENVIRONMENTAL IMPACT OF THE OPERATION, MAINTENANCE AND MANAGEMENT PROGRAM

A. OPERATION OF PROJECT FOR AUTHORIZED PURPOSES

1. Downstream Effects - Regulation of Flows and Releases

a. Flooding Prevented

The Edward MacDowell Dam is operated to reduce flood stages on Nubanusit Brook and along the Contoocook River. There have been 31 significant storage operations, utilizing more than 13 percent of storage capacity, since the project became operational in 1950. Thirteen of these occurred during the month of April, and an additional 11 operations were during the months of January, February and March. It must be remembered, despite the majority of flood control operations in these four months, that serious floods have occurred, and will continue to occur, in places like the Peterborough region during any month of the year.

The impounded waters of MacDowell Reservoir have reached an elevation of 925 feet msl or more, representing 28 percent or more of the reservoir's capacity, on 12 occasions since 1950. The broad flood plain of Nubanusit Brook between West Peterborough and the west edge of Peterborough's central district is vulnerable to very high flood stages, the frequencies of which are now much reduced by the presence of MacDowell Dam. Development of this flood plain area has proceeded with apparent caution, although flood plain zoning ordinances have not yet been enacted by Peterborough.

b. Fish and Wildlife

The New Hampshire Fish and Game Department normally stocks Nubanusit Brook below West Peterborough with brown trout. Trout are also stocked downstream in the Contoocook with probably little carry-over in this stretch of river, and so the stocking is considered to be on a "put-and-take" basis.

Significant changes in downstream flow patterns due to operations of Edward MacDowell Dam occur very rarely, in most years only for a few days up to one or two weeks. In many cases regulation may be conducted without restricting reservoir outflows to less than several hundred cfs during the course of a flood. The reduction of peak flows from this fairly small watershed probably has negligible effect on either the downstream fishery or wildlife inhabiting flood plain areas along Nubanusit Brook. The necessity of maintaining a clear channel for passage of flood waters affects beaver indirectly, since the animals have to be removed whenever they move into downstream reaches of the brook.

c. Vegetative Cover and Timber

Beyond the central precincts of Peterborough the Contoocook River is alternately a meandering river flowing through wide flood plains and a swift-flowing stream in short reaches of constricted valleys. There is considerable natural flood storage provided by the wide marshy flood plains at many spots.

The flood plain stretches of the river generally are covered with vegetative types long since adapted to seasonal and periodic floods. Timber stands of commercial and aesthetic value are found at elevations considerably above the flood stages which have been historically recorded along this valley. Flow regulation in the Nubanusit watershed has relatively minor influence on Contoocook River stages during a flood, and no vegetative changes attributable to this regulation are evident.

D. Water Quality

During normal flow periods the Edward MacDowell Dam impounds a 163-acre conservation pool at 911 feet, mean sea level, which is primarily used as forage area by waterfowl. The pool has a maximum depth of about 7 feet and a mean depth of approximately 1 foot. It has a maximum length of about 8,660 feet and an mean width of approximately 820 feet.

Until recently, a small reach of Nubanusit Brook in Harrisville, New Hampshire was Class D in quality while another downstream portion extending to the head of Lake Skatutakee was classified as "C" water. These reaches, both upstream of the dam, were redesignated as Class B in 1973 after the textile mill causing the water quality degradation closed.

Class B waters have no objectionable physical characteristics. These waters are considered as being acceptable for bathing and other recreational purposes. They can be used as a water supply source

after adequate treatment. There can be no disposal of sewage or waste into Class B water except those which have received adequate treatment to prevent the lowering of the physical, chemical and bacteriological characteristics of the water. The water must be near saturation for dissolved oxygen concentrations, and it must not contain more than 240 coliform bacteria per 100 milliliters.

Periodic water quality monitoring between February and September of 1974 by the New England Division has indicated that all of the dissolved oxygen concentration values in Nubanusit Brook upstream of the conservation pool were between 72 percent and 120 percent saturated. However, other parameters measured in the inflow waters indicate that the waters entering the conservation pool do not meet the Class B standards. A total coliform bacteria value of greater than 1,600 colonies per 100 ml. was measured in June and a value of 700 was measured in July. Hydrogen ion concentrations (pH) as low as 5.3 units were measured. Also, traces of zinc, iron and copper have been reported.

Stanley Brook, a minor tributary to the conservation pool, has had variable quality water since 1971. At that time, dissolved oxygen concentration values reached as low as 35 percent of saturation. In 1974, the summer values indicated 41 percent to 96 percent saturation. The pH values in the brook have dropped to as low as 5.1 units. The total coliform bacteria concentrations measured during the summer of 1974 ranged from approximately 240 to 500 colonies per 100 ml. The presence of zinc and iron has also been detected.

The quality of the water discharged from the conservation pool does not currently meet the New Hampshire objective designation of Class B. Although most of the summer water samples of 1974 have been between 90 percent and 101 percent saturated with dissolved oxygen, a value of 44 percent was obtained. Furthermore, total coliform bacteria were measured at concentrations of 2,800 and 2,400 colonies per 100 milliliters on two occasions in 1974. In August 1974, the fecal coliform bacteria were measured at 1,400 colonies per 100 milliliters. Iron and zinc were also detected in slight amounts.

The presence of these pollutants is not caused by or increased by the existence or operation of the Edward MacDowell project. They are from undetermined upstream sources along the main stem and tributaries of Nubanusit Brook.

e. Recreational Use

The Nubanusit Brook flood plain is the site of Teixeira Park in West Peterborough and the Adams Playground and swimming pool just west of the central business district of Peterborough. There are no reported instances of releases from Edward MacDowell Dam having caused damage or other problems at the recreational facilities in this region.

f. Aesthetics

Vegetative cover along the downstream banks of Nubanusit Brook has adjusted in the 20-year period since construction of

Edward MacDowell Dam. Consequently tree kills and other degradation that might be expected to have an aesthetic impact is less than it might have been when flood waters were uncontrolled. Because of the dam's amelioration of those effects traceable to periods of high water, it is probable that vegetation on the downstream flood plains of both the Nubanusit and Contoocook is more stable now than prior to construction of MacDowell Dam.

2. Upstream Effects in Reservoir

a. Fish and Wildlife

The periodic inundation of Edward MacDowell Reservoir for periods of 10 days or less has had no appreciable effect upon the fisheries in the project area.

The New Hampshire Fish and Game Department has proposed the installation of a low weir across Nubanusit Brook just north of the Spring Road bridge at the site of the former Swett's Dam. The proposed weir would be used to stabilize water levels so as to provide improved and expanded waterfowl habitat. Some years ago this same marshland between Halfmoon Pond and the conservation pool was dredged in a pattern of linear ditches in an attempt to expand and improve this potentially valuable site for waterfowl nesting and feeding. A 126-acre marsh would be created by the weir if the spillway elevation is built at about 912.5 feet msl. The decision on when to build the weir depends upon state budgetary appropriations and possible Federal/state cost-sharing arrangements.

The creation of the marsh behind the weir would be an explicit trade of a marginal terrestrial habitat for a decidedly beneficial aquatic habitat. Inundation of the area in the early spring as a result of flood control operations would not have much of an impact on the waterfowl habitat. Later in the season, however, flood storage could damage or destroy some aquatic plants on which waterfowl depend for food.

Wildlife in portions of the reservoir that are periodically inundated may be affected both by direct losses due to drowning and through alteration of vegetative cover and habitat. Since much of the regularly flooded land is marsh and swamp, aquatic mammals such as beaver, mink, muskrat, otter and others that inhabit the low-lying area are well adapted to changing water levels. The beneficial and detrimental impacts on wildlife of such flooding are not always evident. Winter floods, for example, may result in substantial damage to shrubby vegetation from ice movements. Although the destruction of these plants may reduce the available food supply for browsing species, the Fish and Game Department has pointed out that such ice damage and flooding serve a useful management function in retarding succession on open field areas. Interspersion of open and wooded areas is particularly important for enhancing grouse, pheasant and other upland bird habitat. Spring floods and reservoir inundations, while usually having less effect on vegetation than summer or winter floods, may cause losses of waterfowl broods and the young of other species if they occur during the nesting season.

Trappers have taken as many as 16 beaver in one season from the project area. Muskrats, mink and raccoons have also been successfully trapped in the reservoir. Rather precise monitoring of these game harvests is made possible by the fact that the "landowner" permits required of trappers are, in the case of this area, issued by the New Hampshire Fish and Game Department, the primary manager of the project lands. Furbearers are not generally harmed by, and may even benefit from, reservoir operations and periodic flooding.

b. Vegetative Cover

Much of the regularly flooded area of the reservoir is characterized by swamp and marshland vegetation that is not seriously affected by short periods of inundation. Fluctuating water levels over the past 24 years have had progressively less evident impacts on plant life at higher pool stages. The divisions between open water, marsh, shrub swamp and forest cover reflect to some extent the frequency of flooding at different reservoir elevations.

c. Recreational Use

Public recreational use of the project lands principally involves the activities of fishermen and hunters. Fisherman mostly seek the warm water species of fish to be found in the four permanent ponds within the project's boundaries. An informal boat launch for rowboats and other craft without motors has been established by the public on the east side of the conservation pool; other natural areas suitable for launching small boats or canoes also exist.

Waterfowl hunters also frequent the area during the migratory bird season. Periodic storage operations at the dam have temporarily impeded access for fishermen, hunters and trappers but the inconvenience to users is not serious. Impact of such inundation upon the fisheries and waterfowl has not seriously impaired the value of these resources. Winter sports such as snowmobiling, showshoeing and cross-country skiing are rarely affected by project operations.

Picnicking facilities are provided by the Corps at two sites, one just north of the dam on the west side of the permanent pool (11 tables and eight fireplaces) and another downstream from the dam (five tables and two fireplaces). Neither site is within the flood pool area; therefore, changes in water level have no impact upon the public's use of these facilities.

Alternative and more extensive public recreational facilities for persons visiting the region are to be found at Greenfield State Park, located 10 miles to the north of MacDowell Dam.

Visitors to Boston University's Sargent Camp use Halfmoon Pond and the surrounding land for various recreational activities. The Corps has a flowage easement on this land. The permanent water level at the pond is about one foot below the crest elevation of the spillway, located at the northeast edge of the pond, and flood waters have not yet been backed up into the area. Only when surcharge storage occurs might there be appreciable restriction on use of the camp's land.

d. Beneficial Use of Water

The spillway of the Verney Dam, about 800' downstream from MacDowell Dam, has recently been partially breached so that the level of the conservation pool is now maintained by adjustment of gate settings at MacDowell Dam. The Verney Dam, until recently privately owned, provided the source of water-generated power for one or more mills downstream. At the present time no beneficial use is made by industries or utilities of the waters of Nubanusit Brook within the reservoir area or downstream from it.

e. Aesthetics

A small amount of clearing of land on the margins of the conservation pool was done years ago, but vegetation in most of the reservoir area was left undisturbed. The occasional storage operations in recent years have had no serious or adverse aesthetic effect within the reservoir area; neither have any other accommodations to the project's uses. A borrow pit for sand and gravel used in the construction of the project, just to the east of the permanent conservation pool, has been replanted with pine and autumn olive to cover this landscape scar and improve wildlife habitat. The intrusion of motorbikes into this area is being discouraged in order to prevent erosion and damage to vegetation.

B. OPERATION AND MAINTENANCE OF PROJECT FACILITIES

The picnic facilities close to the dam are conveniently located to attract and serve casual visitors to the project. Extensive wetlands cover a large part of the reservoir making few other sites

favorable for development of additional day-use facilities. Because some fishermen prefer to use canoes and rowboats, an-improved access point is already informally established off the reservoir road on the east side of the pool, but it is sometimes rutted and difficult for vehicular traffic after a rain. Addition of gravel to this short access spur would improve its attractiveness and convenience.

A proposal to raise the level of the permanent pool has been advanced by the N. H. Fish and Game Department so as to improve the potentially valuable waterfowl habitat at the upper end of the pool. This proposal is in addition to the recommended installation of a weir just north of the small bridge at the location of the former Swett's Dam. Because stability of the pool level is especially critical for waterfowl during nesting season (April-June) this proposal could be best implemented by the installation of a weir in front of the control gates or automating the gates to better insure water-level stability.

C. MANAGEMENT OF PROJECT LANDS

1. Rules and Regulations

The main objective of rules and regulations at reservoir lands and waters managed by the Corps is to insure the health and safety of the visiting public. Negative signs and warnings have been held to a minimum so that the public may enjoy the greatest freedom without unnecessary restraint.

Incursion of trail bikes into areas not intended for vehicular use is always a problem, inasmuch as it degrades environmental values and adversely affects the enjoyment of the project area by those travelling on foot. Restrictions on trailbike use might well be included in the signs normally posted at project boundaries and access points. Although use of 200 acres of the project lands and frozen water areas by snowmobiles is permitted no damage to the environment or conflict with other recreational activities has been experienced and no need exists for special rules or regulations concerning snowmobiling.

2. Wildlife Management

The principal focus of wildlife management programs at Edward MacDowell Lake is on aquatic ecosystems. The New Hampshire Fish and Game Department has judged that terrestrial systems are marginal at best and that upgrading of the habitat for waterfowl and other beneficiaries of a managed aquatic environment is justified. Proposals to improve and expand the waterfowl habitat, as previously mentioned, are consistent with this evaluation. The decision to abandon the area as a waterfowl refuge and to adopt instead the principles of general waterfowl management was recently made after studies showing that visiting numbers of waterfowl were no greater during the hunting season than before it. The Fish and Game Department is similarly abandoning a number of other waterfowl refuges throughout the State since they also are not serving the original purpose.

Though there formerly has been stocking of pheasant on project lands, there has not been any stocking recently, due to poor pheasant habitat within the boundaries of the project. Similarly, snowshoe have not been stocked because of poor habitat conditions.

Beaver and other fur-bearing species move into the area from time to time and are harvested by trappers. No specific management program to improve or control populations of these species is presently undertaken, and none seems necessary at this time.

The existing and proposed wildlife management programs appear to be compatible with other uses of the area. The two proposals to improve waterfowl habitat would have an additional and beneficial effect on warm water fisheries. In addition to the enlargement of warm water fish habitat, water levels in the impoundments would generally fluctuate less, and fish spawning and feeding areas would thus be more stable. Use of the area by recreationists other than fishermen and hunters would not be impaired by the implementation of these proposals.

3. Recreational Use and Management

Much of the recreational use of the project area has a direct relationship to the utilization of the area's fish and wildlife resources. Greater emphasis on day-use by picnickers, for example, is not justified because of the lack of environmental diversity and the lack of good sites. Neither does there appear to be any justification for the establishment of camping facilities at the project.

4. Forestry Management

The absence of good timber-growing sites, except in small areas, requires little more in the way of forestry management than the occasional removal of snags in waterways and at other places where vegetation interferes with the utility of the project lands.

Periodic inundation here seems to have had a beneficial effect in setting back natural vegetational succession so as to maintain good waterfowl habitat.

The State of New Hampshire has concluded that the benefits from a specified and routine forestry management program at Edward MacDowell Lake, similar to those undertaken at the Blackwater and Franklin Falls Dam, are not justified by the costs of implementation.

IV. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED AS A RESULT OF THE OPERATION AND MAINTENANCE PROGRAM

A. FISH AND WILDLIFE

Periodic filling of the reservoir, as at other flood control projects, has had some adverse environmental effects. In the case of Edward MacDowell Lake where much of the project land is presently marsh, impacts are mostly restricted to the terrestrial ecosystems. The populations of burrowing wildlife, including insects, rodents and other small animals, are vulnerable to inundations. The severity of impact is mostly dependent upon the season when inundation occurs. Nesting waterfowl may, at times, suffer losses of broods and food supply, depending on the season of flooding and the duration of high water levels.

Reservoir fluctuations unavoidably disrupt warm water fish habitat and may adversely affect spawning success, although no actual observations of field data have been collected to estimate the magnitude or importance of such changes. No downstream effects of flow regulation on fish and wildlife in Nubanusit Brook have been reported. The reduction of spring freshet flows may curtail flooding of undeveloped riverine wetlands thereby reducing the extent of normal nutrient and organic matter exchange, but this effect is unavoidable because of the need to protect structures located in other flood plain areas.

B. WATER QUALITY

The release of flood waters sometimes results in temporary increase in downstream turbidity. Although unavoidable, it is doubtful that such short-term changes have any measureable adverse effect on water and stream uses below the dam. No other parameters of water quality appear to be detrimentally affected by the authorized flood control operations of the dam.

C. VEGETATIVE COVER AND TIMBER

Inundation of the reservoir area may occur at any time of the year, though flooding is most likely to occur in the spring. If, however, flooding of the reservoir occurs during the height of the growing season and lasts for more than a few days serious damage or loss of most of the vegetation which is overtopped by the floodwaters may occur.

Periodic inundation has the effect of setting back, or delaying, successional stages of plant growth. As earlier explained this may be considered an adverse effect by those valuing natural environments, but, in the case of a managed waterfowl habitat, there are compensating beneficial effects.

V. ALTERNATIVES TO THE OPERATION, MAINTENANCE AND MANAGEMENT PROGRAM

A. DISCONTINUANCE OF AUTHORIZED FLOOD CONTROL OPERATION

The damage inflicted on Peterborough during the 1936 and 1938 floods is well remembered by many who still reside and work in that town. The rebuilding and expansion of much of the central business district along the banks of Nubanusit Brook and the Contoocook River has been undertaken, however, since Edward MacDowell Dam was built. The increased safety afforded by the dam has certainly been taken into account. Should there cease to be protection from floods which is now provided by MacDowell Dam it is undeniable that property values in an important part of Peterborough would plummet and the threat of a major flood disaster would increase greatly.

Because alternative flood control measures such as flood plain zoning have been slow to be accepted and implemented in the Contoocook Valley, there has been a gradual encroachment by all sectors of society upon the vulnerable flood plains. A decision made now or in the future to discontinue the protection now afforded by MacDowell

Dam should include assessment of the added risk and costs imposed by development and growth taking place in downstream flood-prone areas.

B. LAND MANAGEMENT ALTERNATIVES

1. Discontinuance of Land Management Activities

Land management activities at Edward MacDowell Lake, besides those supporting the project's flood control operations, are carried out mainly by the New Hampshire Fish and Game Department to enhance the fisheries and wildlife resources of the area. Without conscious management, particularly of waterfowl habitat, it is likely that the stock of these resources would diminish and their utilization by the public would decline. Increasing pressures on game of all sorts is primarily the result of the intrusion of man-made developments into wildlife habitats and the despoilation of food and other essential resources. The preservation, conservation and enhancement of an environment well suited for species which are under such increasing pressures is the aim of the present management program.

2. Single Purpose Versus Multiple Use Management

Fisheries and wildlife management, with an emphasis on the improvement of waterfowl habitat, are the only current and specific management practices undertaken on the project, and even these are presently on a maintenance basis until proposals for expanded management can be evaluated and funded.

Project lands are presently available for nonintensive recreational use by fishermen, hunters, hikers, picnickers and snowmobilers,

but there are limitations on these activities due to the area's topography and recurrent flooding. The permanent pool area presents problems for development of a shoreline picnicking and swimming facility because of the pool's shallow depth and regular inundation as well as access and site limitations for supporting facilities. Areas further upstream in the reservoir are also not very feasible for intensive day-use recreation because of their natural wetland character. Therefore, since much of the reservoir is marsh and shallow open water the year round, the greatest potential for expanded recreational use is for those activities which focus on the aquatic resources. Access by fishermen to Beaver and Dinsmoor Ponds, for example, remains a problem. The opening paths through the clumps of reeds and other vegetation encircling these ponds might invite greater visitation by duck hunters and fisherman with small and light-weight watercraft.

Boston University operates its Sargent Camp facilities on Halfmoon Pond as an environmental education center. Because these plans include both university student and public participation in a variety of programs there is the opportunity and possibility of coordination of land use policies by those landowners, including the Corps, with property in the vicinity of Halfmoon Pond. Public participants attracted to Sargent Camp's programs and displays, for instance, may utilize the resources on Corps-owned land.

C. OPERATION AND MAINTENANCE ALTERNATIVES

The main function of neighboring Boston University's Sargent Camp is to invite interested persons and public groups to take part in a variety of environmentally oriented programs. The opportunity exists for the Corps, in cooperation with persons from Sargent Camp, to lay out trails, observation sites, and other facilities which will expand the educational opportunities for visitors to Sargent Camp. Aquatic biologists, limnologists, botanists and waterfowl specialists are among those who would and could find a variety of sites on the Corps-owned land which might be utilized for teaching and demonstration purposes. Some initiative on the part of the Corps, therefore, to coordinate its management policies with the activities now underway at Sargent Camp may be appropriate.

VI. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

A. FLOOD CONTROL BENEFITS

The experience of Peterborough and other communities in the region during the 1936 and 1938 flood disasters did much to support the decision to build an upstream flood control structure. Dams in addition to the MacDowell project have, in the past, been proposed for the upper part of the Contoocook Valley, but none have been built. With the construction of MacDowell Dam much of the town of Peterborough was rebuilt in the 1950's and 60's within the limits of safety provided by upstream storage. Had the dam not been built much of present-day Peterborough would be under the constant threat of

serious flooding. Alternatively, had the decision been made to relocate those businesses and enterprises which had previously been developed in the potential floodway, the town of Peterborough would be quite a different place today.

Choice of options such as that made at Peterborough is most efficiently made at the local level. But at the same time, there is a high degree of regional interest in what at first glance appears to be a matter of local concern. This interest arises from the complex interdependencies which exist: State and Federal tax support for flood control measures, a town's provision of regional services, regional economic demands upon industries and other facilities in population centers and other factors. Therefore, the growing concern for the complete array of flood management alternatives will influence future decisions which involve appraising flood risk, land use and the like in the Nubanusit and downstream Contoocook valleys. Policies which balance economic growth in flood-prone areas with the cost of flood protection and also take into consideration environmental and social values, are of considerable import to many groups and agencies today. Although Edward MacDowell Dam provides very real flood control benefits, it is recognized that structures alone cannot solve the flood problem and other strategies are needed in the long run to complement structural flood control programs in the Contoocook River watershed.

B. RECREATIONAL BENEFITS

There has been minimal commitment of the project's resources to improve recreational uses, and the options for future development of some specific, mostly water-related recreational benefits remain. However, existing uses of the project's land and water resources for hunting, fishing, snowmobiling, boating, hiking and other pursuits are perhaps best served by the absence of developed recreational facilities. Therefore, deferral of a commitment to provide for increased picnicking and other concentrated recreational land uses should continue until periodic reviews justify policy changes which might, in time, support development of facilities for more intensive uses of the project. The avoidance of a course of action leading to high visitation, such as might occur with expanded picnicking areas and provision of swimming facilities, may be the best way to maintain and enhance the longterm productivity and value of the reservoir, simply because relatively natural, unspoiled and undeveloped land is becoming more and more scarce.

The management of fisheries and wildlife resources supports short-term uses of the reservoir by hunters, fishermen and others, but at the same time it is the aim of these management programs to sustain the long-term productivity of the wildlife resources.

C. BIOLOGICAL COMMUNITIES AND ECOSYSTEMS

Alteration of flow patterns in the Nubanusit and downstream Contoocook valleys does not appear to have had serious or lasting effects on fish, wildlife, or vegetation in these areas. Further-

more, runoff from uncontrolled drainage areas both upstream and downstream from Nubanusit Brook on the Contoocook River masks whatever flow deficiencies are caused by impounding flood waters at MacDowell Dam. Some short-term benefits are afforded those few persons who grow hay and pasture forage on the Nubanusit flood plains and whose crops are saved from periodic inundation. The same protection, but to a lesser extent, is given to agricultural areas downstream from Peterborough. But, the replenishment of nutrients provided by floodwaters periodically covering flood plains is denied these same areas.

In addition, and often more significantly, the productivity of biological communities is more seriously threatened by the encroachment of developments of one sort or another into the flood plain areas than by alternation of a river's flow regime. Structural devices affording some measure of flood protection often encourage this kind of encroachment on natural flood plains. When the conflict or competition between these incompatible uses of resources of the flood plains is resolved in favor of development, the long-term productivity of natural ecosystems is thereby diminished.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES INVOLVED IN THE OPERATION AND MAINTENANCE PROGRAM

Because much of the area of Edward MacDowell Reservoir was marsh and open water long before the dam was built, the irretrievable commitment of natural resources to the project is less severe than it might otherwise have been. However, some areas, such as the east

side of the reservoir, were once wooded and have become shrub covered. Periodic inundation has the effect of preventing plant succession, and areas from which forests have been removed or prevented from reestablishing themselves are, and will be, unproductive of timber resources for as long as flood storage operations are continued. In the present regional context, however, this loss is not considered serious.

The maintenance of the spillway channel where only brush is allowed to grow is a similar instance of the loss of woodland resources, both plant and animal. In addition to the physical removal of a woodland habitat and replacement by a rock-bottomed, brush-covered, linear zone there has been some local interference with wildlife migration and range patterns imposed by this man-made and fenced zone. Though adjustments have been made by the animals affected, the continued existence of this barrier has the effect of restricting or influencing the ranges, and therefore the numbers, of some species that might be expected to traverse the north-south ridge lying just east of most of the project lands.

Vegetation losses, and also those losses which occur to animal life supported by vegetation resources, are judged to be relatively insignificant throughout the remainder and major part of the project.

VIII. COORDINATION WITH OTHER AGENCIES

Coordination with several Federal, State and local interests resulted in valuable input to this assessment. The following is a list of those with whom coordination took place:

U. S. Fish and Wildlife Service

New Hampshire Fish and Game Department

New Hampshire Division of Parks

New Hampshire Division of Forestry

Monadnock Region Association

Boston University's Sargent Camp

Upon evaluating the material presented in this Environmental Assessment, it is my belief that continued operation, maintenance and management of the Edward MacDowell Lake flood control project is in the best public interest. To discontinue operation of this project could cause serious flooding downstream of the dam with significant property damage. Public recreation opportunities provided at the project would also be lost if management of the area ceased.

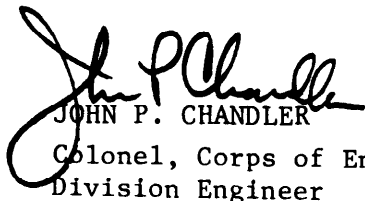
Environmentally, the operation, maintenance and management of Edward MacDowell Lake has only a minor impact. The downstream aquatic and terrestrial ecosystems have been altered somewhat due to reduced natural flooding. Impoundment of flood waters in the reservoir has minimal effects on fish reproduction, wildlife habitat and vegetation since the duration of inundation is usually rather short and usually at non-critical times of year.

Therefore, since the environmental impacts of continued operation, maintenance and management of the Edward Mac Dowell Lake Flood Control Reservoir are minor, a formal environmental statement is not required under the provisions of the National Environmental Policy Act of 1969.

It is my opinion that the public will best be served by continuing operation of Edward MacDowell Lake.

21 October 1976

(date)


JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer